"The object probably had its radiant south of Orion, and its course lay from about the English Channel, south of Devon, to the coast of Holland. The whole of the path traversed must have been about 520 miles, but the heights cannot be exactly determined from the materials. Another good description of the apparent flight would be very valuable. The night was clear, and many persons in the south-eastern counties must have had a fine view of the phenomenon."

The Photographic Spectrum of Nova Lacertæ.—In No. 4473 of the *Astronomische Nachrichten* Dr. Max Wolf reproduces and describes the photograph of the spectrum of Nova Lacertæ which he took with the Zeiss two-prism spectrograph (exposure 90m.) on January 13. At first glance the spectrum consists of seven broad bright bands, of which six are accounted for by the hydrogen lines $H\beta$–$H\eta$; the seventh has a wave-length of about 463 $\mu\mu$. The nova spectrum declines abruptly in intensity at about λ 360, not extending nearly so far into the ultra-violet as do the spectra of the Orion stars. The order of brightness of the broad bands is $H\gamma$, $H\delta$, 463, $H\epsilon$, $H\beta$, $H\zeta$, $H\eta$. Dr. Wolf gives the wave-length measures of the different parts of each band, and also finds other faint bands having their centres at the wave-lengths 451·3, 447·4, 443·4, and 405·8; three other broad, faint bands have their maxima at $\lambda\lambda$ 427·3, 425·6, and 422·9.

Recent Observation of Halley's Comet.—To *The Observatory* (No. 432) Prof. Barnard sends the following observation of Halley's comet on January 8, at 21h. 30m. 56s. G.M.T.:—R.A. = 11h. 47m. 16·65s., apparent dec. 18° 24′ 44·3″ S. The comet was 32·8″ diameter, round, and slightly condensed, but had no nucleus. With the 40-inch refractor, its magnitude was estimated to be 13 or 14. Prof. Barnard hopes to be able to follow the comet for the greater part of the present year, and this will provide an enormous arc, over which the comet has been observed during the present return; the determination of its path during this revolution will thus be considerably simplified. In April next the comet will be as far from the sun as is Jupiter.

Search-ephemerides for Westphal's Comet (1852 IV.).—In No. 4475 of the *Astronomische Nachrichten* Herr A. Hnatek publishes three search-ephemerides for Westphal's comet, which may be found during the coming spring or summer. The three ephemerides are based on the assumptions that the period of the comet may be sixty, sixty-one, or sixty-two years respectively, and each covers the period April 10 to September 7. The rediscovery is doubtful, however, for the calculated magnitudes lie between 10·3 (August 28, 1911) and 13·4.

Observations of the Zodiacal Light and the Gegenschein.—Herr Banachiewicz describes a brilliant apparition of the zodiacal light, seen at Kasan on January 26–27, in No. 4474 of the *Astronomische Nachrichten.* The light extended to Saturn, and the middle of its pyramidal form passed over the stars δ, ϵ, and ζ Piscium. As compared with the Milky Way, the light appeared of a slightly reddish hue, and, so far as the two phenomena can be compared for brightness, was about equally bright.

Observations of the counterglow, or gegenschein, were made by Mr. Innes, Mr. and Mrs. Wood, and Mr. Worssell at the Transvaal Observatory during September and October, 1910, and are published, with sketches, in No. 5 of the Circular. Mr. Innes reports that on September 24, 25, and 26 the counterglow was, and had been, remarkably distinct, lying along the ecliptic as a lens-shaped mass about 10° broad and about 90° long; in spite of the sky-illumination from electric lights and veld fires, visitors were able to see the phenomenon immediately their attention was directed to it. Mr. Worssell gives its approximate limits on October 4 at 9h. 40m. (G.M.T.) as N. +17·5°, S. −4·5°, preceding, 0h. 5m. and following 1h. 20m., thus making the position of the centre R.A. 0h. 32m., dec. +5½°.

The Murnpeowie Meteorite.—The annual report of the South Australian School of Mines for 1909 contains a very interesting description of the iron meteorite discovered in August of that year. The discovery was made by some boundary-fence repairers working near Murnpeowie, Lat. S. 29° 35′ L. and Long. 139° 54′. Mr. L. Laybourne Smith, the curator of the museum, says the country at this place is flat and devoid of stones. The object is a siderite weighing 2520lb., its greatest height 35 inches. The chemical composition has not been determined. Mr. Smith is making inquiries with a view to finding the date of the fall. "Australian bushmen are very observant, and this isolated 'rock' would not have been overlooked in a position less than half a mile from where the fencers were working. The holes also would fill with sand in a few years. It is probable, therefore, that the Murnpeowie meteorite is a recent arrival."

INTERNATIONAL HYGIENE EXHIBITION, DRESDEN, 1911.

For some months past very conflicting statements as to the attitude of the Government towards the International Hygiene Exhibition to be held in Dresden have been made, but we are now assured that the President of the Board of Trade has given it his blessing, and that some of those who have hitherto held aloof, owing to some misunderstanding, have expressed their approval of the movement. It is to be hoped, therefore, that Great Britain will be properly represented in what promises to be one of the most important scientific exhibitions and congresses of modern times. This exhibition is not merely for the advertising of trade products, nor is it intended that it should compete in any way with such trade exhibitions as, for example, that to be held at Turin. Rather is it to be a collection of apparatus and appliances, so arranged and classified that experts or others interested in matters pertaining to hygiene may study, compare, and contrast the most modern and best hygienic contrivances.

Our German cousins, with their genius for organisation and attention to detail, have spared neither trouble nor expense in laying solid foundations, and it now rests with other countries to assist in the building of an adequate superstructure. Great Britain can ill afford to be behind in a race in which, hitherto, her lead has been pre-eminent; and although she must do voluntarily, through individuals and private organisations, what by other countries is done by the State, it is to be hoped that now all misunderstanding has been cleared away a united effort will be made, not only to raise the rest of the necessary funds, but to send sufficiently imposing exhibits.

Some idea of the thoroughness of the work that is being done may be gathered from the fact that a "News Bureau," from which is issued what may be called a small newspaper—*Hygieia,* has been formed in connection with the exhibition. Of this leaflet, Nos. 16, 18, and 19, all of them published in January of this year, may here be referred to. The first deals with the department of "statistics," and not only affords an indication as to the objects of the promoters of the exhibition, but serves as a guide to would-be exhibitors as to what is most likely to be of use and interest to the "public" whom this exhibition is expected to attract. We are told that the collection of statistics brought together by the German Government has cost something like 350,000*l.*, that games and their influence on health will be illustrated, and that the various implements employed in carrying on these games will be fully set forth. The hygiene of civilised life will naturally receive most attention, but the method of life of savage tribes will also be demonstrated—dwellings, food, mode of life, and the like, of bushmen, Australian aborigines, primitive Indians, North American Indians, all being illustrated. One of the leaflets is devoted almost entirely to milk, under such headings as hygiene of milk; exhibits of apparatus and methods for the bacteriological investigation of milk; models, drawings, and photographs to show the dangers arising from dirty milk; the proper treatment of milk practicable even in small dairies; methods of sterilisation and milk inspection; and the hygiene of butter and cheese. Hygienic cowhouses and fittings, and the best methods of keeping cattle in dairies, and so on.

Another leaflet, No. 19, deals with subjects very different in character—the action of light and special forms of light, such as the ultra-violet rays, the action of radium, and radio-active substances; and then darts off suddenly into an entirely new region, where exhibits and statistics con-

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cerning sick clubs, insurance against illness, and many of those other schemes promoted by the German Government, the importance of which is now being so fully realised in other parts of the world, are to be on view.

It is to be hoped that now the matter has been taken up, those interested in British sanitary science and the scientific aspects of hygiene generally, will spare no effort to make the British exhibit, in part at least, worthy of those great leaders of sanitary science who, shortly after the middle of the last century, did so much, not only for Great Britain, but also for other civilised countries.

THE RUSTING OF IRON.

THE problem of the atmospheric corrosion of metals is a very old one. So long ago as 1769, only three years after Cavendish had demonstrated the solubility of chalk and magnesia in water charged with "fixed air" or carbonic anhydride, it was shown by T. Lane, an apothecary of the City of London, that "water impregnated with fixed air will dissolve a considerable quantity of iron, and thereby become a strong chalybeate" (Priestley, "Experiments on Air," 1772). Lane records (Phil. Trans., 1869, l., 218) that "the clear water . . . decanted from the filings and ochrous sediment . . ., being exposed to the open air, presently threw up a party-coloured pellicle, and deposited a yellowish sediment."

In this way the foundations were laid for the theory of rusting put forward in 1888 by Crum Brown, according to which the action consists essentially in the dissolution of iron by carbonic acid, and subsequent precipitation from the solution of ferrous bicarbonate of ferric hydroxide formed by the interaction of the ferrous salt with atmospheric oxygen; the separation of the rust is accompanied by the liberation of the carbonic acid, which is thus set free to attack a further quantity of iron.

The correctness of Crum Brown's theory was confirmed by Moody's observation (Trans. Chem. Soc., 1906, lxxxix., 720) that iron which had been cleaned with chromic acid could be kept for long periods in contact with water and air in a glass tube from which all traces of carbonic acid were carefully excluded. Friend (Proc. Chem. Soc., 1910, xxvi., 179) has confirmed this observation by condensing water distilled from an alkali upon an iron tube cooled by circulating water.

In a paper which has recently appeared in the Journal of the Chemical Society, Messrs. Lambert and Thomson have arrived at conclusions differing somewhat from those of Moody and Friend. By electrolysing ferric chloride between electrodes of pure iridium foil, a specimen of iron was obtained which gave a crystalline nitrate entirely free from the violet colour which usually characterises this salt and ordinary ferric alum; the nitrate was transferred to an iridium boat, ignited, and reduced in a stream of hydrogen in a silica tube at 1000°. The metal thus obtained (which appears to have been so pure as to be acid-proof, like the redistilled zinc prepared some years ago in Sir William Ramsay's laboratory) was found to be unacted on by purified oxygen and purified water, but when platinum vessels were used in preparing the iron, the metal was found to be oxidised in the course of two or three hours, and a similar result was observed in the case of commercial iron, whether it was cleaned with chromic acid or not.

The different results thus obtained may very possibly be attributed to a difference in the vessels in which the iron was exposed to the action of water and oxygen. The dominant factor in promoting the atmospheric corrosion of iron is undoubtedly carbonic acid, but there is no reason to suppose that the part of the carbonic acid might not be played by any other acid strong enough to act upon the iron, though weak enough to be liberated by oxidation from the ferrous to the ferric state. Silicic acid, the immediate homologue of carbonic acid in the periodic classification of the elements, might very possibly be capable of producing a like effect, and, if so, the use of silica tubes would be likely to promote rusting to a far larger extent than tubes made of glass. The use of silica tubes by Messrs. Lambert and Thomson in an experiment in which one of the main objects was to eliminate acid impurities is a change of which the advantages are very questionable. The soluble (alkaline) matter dissolved out from ordinary glass does not suffice under normal conditions to prevent rusting from taking place in glass vessels, but it is noteworthy that under the conditions of Moody's experiments contact with the actual (acid ?) surface of the glass was sufficient to cause the metal to rust, whilst Friend has recorded a similar effect produced by particles of slag embedded in the iron. T. M. L.

ECONOMIC GEOLOGY IN THE UNITED STATES.[1]

THE three bulletins referred to below have been issued by the United States Geological Survey, which, at all times keenly alive to the importance of economic geology to the nation, has of late years been paying particular attention to the study of the mineral resources of the United States. The two first bulletins give an elaborate and detailed account of the geology of one of the most important oil-producing regions of central California. Very little accurate geological work had been done here previously, so that the present bulletins form a useful contribution to general stratigraphical geology as well as to the special geology of oil-bearing regions. There is nothing that calls for particular notice in these bulletins; the oil appears to occur in strata of the customary type of Eocene, Lower and Middle Miocene age. Both reports are elaborate and full of detail, and the report on the Coolinga district is noteworthy for the amount of palæontological information that it contains and for the admirable manner in which some of the fossils referred to have been illustrated in the accompanying plates.

The third of these bulletins deals with an entirely different subject, namely, the methods recently introduced by the United States Government for the purpose of placing its system of purchasing its coal supplies upon a scientific basis. The method is roughly as follows:—For each coal the moisture, ash, and calorific value (expressed in British thermal units) are determined upon samples taken with all due precautions. The bids of the various samples are sent in on official sealed forms. In order to compare these, all the tenders are reduced to the same ash value by selecting as standard the coal containing the lowest percentage of ash; for each 1 per cent. of ash above this figure, 2 cents per ton is added to the tender price. From this price thus adjusted, and from the calorific power as determined, the cost per 1,000,000 B.T.U. is calculated for each coal offered, and as a general rule the contract is awarded to the lowest cost as thus ascertained. As the heat value of the coal is determined upon the coal as received, there is no necessity to determine the percentage of moisture that it contains. When a tender has been awarded to a contractor, he is expected to maintain the quality of the coal delivered at approximately the same standard as that upon which the contract was awarded. For this purpose careful samples are taken from each delivery; when the samples have been drawn, payment of 90 per cent. of the amount of the account is made forthwith, the balance being kept in hand until the samples are reported upon. The price is corrected for variation in calorific power, by multiplying by the number of B.T.U. in the sample and dividing by the number of B.T.U. upon which the contract was based. Similarly for each 1 per cent. less of ash in the sample of the coal delivered, a premium of 2 cents per ton is paid, and for each 1 per cent. of ash more a deduction is made in accordance with a published schedule, an increase up to 2 per cent. of ash not being, however, penalised. Of course the contract note contains clauses under which a delivery containing an excessive amount of ash, dust, or sulphur may be entirely rejected.

It will be seen that this system of coal purchasing is novel, and interesting to a wider public than that directly concerned with the supply of coal to the various departments of the United States Government. H. L.

[1] Department of the Interior. United States Geological Survey Bulletins. (Washington, 1910.)

(1) Geology and Oil Resources of the Coolinga District, California. By Ralph Arnold and Robert Anderson. Pp. 354.

(2) Preliminary Report on the McKittrick-Sunset Oil Region, Peru, and San Luis Obispo Counties, California. By Ralph Arnold and Harry R. Johnson. Pp. 225.

(3) The Purchase of Coal by the Government under Specifications; with Analyses of Coal delivered for the Fiscal Year 1908–9. By George S. Pope. Pp. 80.

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